

Abstract of the Disclosure

One embodiment of the present invention is an electron beam treatment apparatus that includes: (a) a chamber; (b) a cathode having a surface of relatively large area that is exposed to an inside of the chamber; (c) an anode having holes therein that is disposed inside the chamber and spaced apart from the cathode by a working distance; (d) a wafer holder disposed inside the chamber facing the anode; (e) a source of negative voltage whose output is applied to the cathode to provide a cathode voltage; (f) a source of voltage whose output is applied to the anode; (g) a gas inlet adapted to admit gas into the chamber at an introduction rate; and (h) a pump adapted to exhaust gas from the chamber at an exhaust rate, the introduction rate and the exhaust rate providing a gas pressure in the chamber; wherein values of cathode voltage, gas pressure, and the working distance are such that there is no arcing between the cathode and anode and the working distance is greater than an electron mean free path.